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ABSTRACT

Several recent studies concerning the influence of gender on academic achievement from elementary school through college are reviewed. The research covered focuses on: (1) academic attainment by gender; (2) achievement differences between males and females; (3) causes of achievement differences; (4) hemispheric brain preferences; (5) differential socialization through play and toys; (6) physiological and social differences; (7) the relation of task characteristics to achievement differences; (8) the role of ethnicity in gender differences; (9) the influence of classroom environment on gender differences in academic achievement; (10) academic areas in which sex differences are and are not found; (11) sex role expectations; and (12) cultural influences on pupil-teacher interaction. Concluding remarks focus on the educator's role in eradicating gender bias. Twenty-three references are cited. (RH)

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Gender and Academic Achievement in Education

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Gender or sex difference and its effect on achievement in education has been the subject of numerous studies. There have been studies that show male superiority in certain subject areas and female superiority in other disciplines. Studies have indicated biological, hereditary, and environmental factors are influencial in the learning process and determine certain differences that show up between the sexes. Much of the work has been done in the area of mathematics, but other studies in the sciences, physical education, language, and play also offer important information. In this paper we will examine some of the more recent work completed on the influence of gender on academic achievement.

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When one speaks of gender and academic achievement the question of ability and sex is raised. Mickelson (1989) says that female underachievement is a myth. Women are doing as well as men academically and are surpassing the achievement levels of men in many areas. More girls than boys are graduating from high school. More women receive baccalaureate degrees than men and presently outnumber men in master's degree programs. Although more men are in doctoral programs, this gap too is closing. There is still a difference in areas of specialization: women in the social sciences and humanities, men in mathematics, engineering, and sciences, but this difference is also diminishing.

What kind of achievement differences do exist between male and female? Have the differences been caused by environmental

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factors, or are there biological causes? Aikens (1987) states that certain studies implicate a biological difference that helps explain the differences found in math achievement. There may be hereditary differences between the sexes such as a sex-linked recessive gene that helps determine mathematical ability. Hormonal differences between the sexes have also been offered as an explanation. Other studies Aiken looked at attested to a difference in cerebral lateralization or brain dominance. The left hemisphere in the brain thought to control the verbal ability and the right hemisphere thought to control spatial ability may develop differently according to sex.

Supporting brain structure variance, Aiken reported that females scored higher on tests of perceptual speed and accuracy, rote memory, numerical computation, verbal fluency, and language-type tasks. Males, in contrast, scored higher on mathematic reasoning, visuospatial ability, mechanical ability, and speed and coordination of large bodily movements. Burns and Reynolds (1988) had similar findings, although the differences found were small.

A 1986 study by Fountain of 131 white, average and above average ability fourth and seventh grade students found a significant difference in hemisphere brain preferences between males and females. More females had integrated-hemishphere preferences which resulted in higher scores in math, reading, and language than the left or right-hemispheric preference students. This was found to be more significant on the fourth grade level.

Other studies have concluded that environment, even from an early age, influences academic achievement in children. Greenberg (1986) reported that play activities among young children can shape their learning abilities for years to come. Gender is probably the most important factor in choosing a toy for a child or selecting the type of play in which a child is to be engaged.

Boys' toys and play promote exploration and experimentation. They often include scientific principles or encourage outdoor play with movement and activity. Girls' play and toys often require small muscle development and hand-eye coordination as they manipulte small toys and dolls. This play helps girls recognize small differences, is often highly verbal, and is more frequently under adult supervision. Boys' activities, according to Spatig (1986), tend to be more competitive, adversarial, and combative, while girls are involved in non-violent and nurturant activities.

Because of the type of play and toys, Greenberg states the girls are often better prepared for early school activities. They have had a preparation for beginning reading and writing and discipline. Schools are often geared to remediate, through the type of instruction given, boys' weaknesses and lack of skills. Girls' need for exploring, experimenting, and large muscle activities are often ignored, and they continue to receive instruction in the areas where they are already strong.

Nelson (1986), studying motor skills development among young children, found both biological and environmental factors

present. Boys were found to have greater joint diameters and more arm muscle. They often played with older children and played different types of games. Parents treated boys and girls differently and expected different sex-role behavior. Nelson stated that our cultural expectations influence the choice of different motor tasks and therefore dictates a different developmental pattern between girls and boys. The gender differences in motor performance continue to increase as the students progress in the elementary grades.

Marshall and Smith (1987) concur that there are differences between the sexes in achievement in the early years. Girls have a greater capacity for sitting still in class and a greater skill "routinizing well-defined procedural tasks" such as one finds in adding or subtracting. The way of thinking may favor girls in computation, since they seem to have well-developed rules for the different arithmetic operations. Boys, however, have an easier time with problem solving, since they tend not to set automatic rules and approach each problem differently.

Loesch-Griffin (1986) supported this view stating that boys will score higher on novel tasks, while girls will have better results on structured tasks. She followed this by saying boys will excel in oral presentations and spontaneous problem-solving, while girls will achieve at written presentations of solutions to the familiar and structured problem situation.

An Hawaiian study of fourth, sixth, and eighth graders of four ethnic groups revealed that girls had an overall higher

achievement level in math than boys (Brandon, et. al., 1987). This opposed the results of many current studies, and the conclusion that ethnicity may play a role was stated. However, the finding that boys were higher in mathematical reasoning while girls excelled in computation did agree with other studies.

Computer studies have been viewed as being more appropriate for boys than for girls. Johnson and Swoope (1987) investigated the interest among elementary students for computer activities. They found that while all sudents had a high interest in computers, both the boys and the girls perceived boys' interest as being higher. It was noted that boys often manipulated school situations in order that they could control or dominate computer useage. The researchers thought that with such situations occurring and the perception that computers were a male domain, females are handicapped in this computer-intensive environment in which we live.

Other elementary classroom environments also seemed to affect the academic achievement of one sex over the other. Berliner (1988), reviewing work done by Elizabeth Fennema and Penelope Peterson, draws four conclusions. First, teachers interact with boys more often in math lessons in ways that challenge them to achieve. Interaction with girls were more remedial in nature. Second, competition in math by timed tests or instructional games hurt the achievement by girls because the boys were more competitive and aggressive. Third, cooperative learning strategies helped girls achieve more than boys on higher-level math activities. Fourth, working independently, girls did

well when socialization was not allowed. Generally, it was found that girls were allowed to socialize more than boys during class because it was not as disruptive. Boys were restricted and therefore had more time on task and achieved at a higher rate.

Not all studies have shown differences due to sex at the elementary level. Work by Simmons (1986) showed no difference in achievement even using different learning modalities. Zerega (1986) found no significant sex difference in science achievement at the early adolescent level. Moller (1982) reported no significant difference in math achievement. In a study of reading, Hall (1987) recorded similar achievement scores between boys and girls in reading comprehension, sight vocabulary, and vocabulary in context. Any difference in scores between sex could be attributed to cultural attitudes rather than physiological factors. Freeman (1984), in reviewing and synthesizing the findings of thirty-five studies, stated that there was no strong support for overall gender differences in mathematical achievement by the time students reached junior high school.

As students enter high school and college certain differences in achievement become apparent. Differences in math seem to favor males (Reyes and Stanic, 1988; Strauss, 1988; Aiken, 1987). Significant differences to the advantage of males was seen in biology, general science, physics, and computer studies (Becker, 1989; Nickell, et. al., 1987).

Many reasons for males scoring significantly above females

in certain areas are put forth. Jones and Wheatley (1988) quoting Levy say:

> "Teacher's attitudes supplement and reinforce the institutional sexism of high schools. A recent exploratory study of the sex-role attitudes of secondary teachers...indicated that most of them differentiated ideal behaviors by sex. They wanted males to be dominant, independent, and assertive, and adolescent females to be submissive, dependent, unassertive, emotional, and concerned about their appearance. Also in response to a statement about a competent student interested in math and science, teachers indicated they would encourage a boy to build on that interest but be concerned that a girl develop competencies in areas besides mathematics and science to avoid becoming lopsided" (p.136).

Aiken (1987) says it could be teachers' and counselors' attitudes, but there are other influences as well. Males tend to have a greater exposure to math and science principles. In the activities outside school they tend to practice skills related to these areas more than females. The training for girls in certain areas in high school is weak. Girls have few role models, including parents, that emphasize or illustrate the importance of math and science in every day usage and occupations. Personality characteristics, such as conformity or feelings of inadequacy, work against female achievement in these areas.

Sex role expectations and gender identity are other drawbacks to female excellence in some academic areas. Peer values also influence decisions on which classes to take in high school as well as which occupation one should pursue.

Burdick (1987) asserts that culture and gender affect the way in which students interact with teachers, classmates, and

the environment. Girls tend to respond less in the classroom and therefore receive less of the teacher's ime. Boys' assertiveness tends to get the teacher's attention, and the interaction that takes place and the instruction given is therefore geared to males.

Because of the apparent discrepancy that occurs at the higher academic levels between sexes, there is a call for improvement and change so that appropriate provisions are made for all students. The National Council of Teachers of Mathematics (NCTM) recommended that "all mathematically talented and gifted students should be enrolled in a program that provides a broad and enriched view of mathematics in a context of higher expectation" (Strauss, p.536). This statement could be expanded to include all academic areas.

Change can occur at the primary education level where a balanced play curriculum is emphasized. Play should include inside, outside, small group, large group, large motor, small motor, experimental, repetitive, exploratory, and verbal activities (Greenberg, 1986).

Educators at all levels should become familiar with the new findings on the function of the brain and the implications for education. They should be aware of their own attitudes toward the different sexes. They should examine the way they interact with students of both sexes.

The NCTM recommends that teachers:

1. help the gifted girls achieve their best.
2. read and apply the findings on the female student, giftedness, and math.

3. assure equal opportunity in the classroom.
4. encourage girls to be assertive.
5. encourage more research in the area of sex differences and achievement (Strauss, p.536).

Along with this Strauss also suggests that schools have all-female math remediation and acceleration classes to encourage excellence in math among girls.

Teachers in the classroom can also invite guest speakers who are good role models for both sexes. One should demonstrate the usefulness and application of all subject areas to students expecting all to excel. Students should be shown the career relevance of subjects, so that they can make informed class choices.

The teacher should have equitable patterns of reinforcement, discipline, directions, levels of questions, and non-verbal behaviors. The climate in the classroom should encourage confidence and independence for all students. Expectations for male and female students should be equal. Rid the classroom of sex stereotypes. These steps will lead to improvement of equality for both sexes.

Research on gender and academic achievement has to continue, and ideas and recommendations generated by the research has to be applied to education. Then all students may be assured they will receive the opportunity to achieve to their greatest potential in all subject areas regardless of gender.

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